

From the Author

ART. VII.—*On the Diagnosis of Fractures of the Neck of the Femur.* By ROBERT WILLIAM SMITH, A. M., Licentiate of the Royal College of Surgeons, Curator to the Museum of the Richmond Surgical Hospital, &c. &c.

(Read at a Meeting of the Surgical Society of Ireland, April 5th, 1834.)

NOTWITHSTANDING the accuracy and minuteness with which the symptoms of fracture of the neck of the femur have been detailed by all practical writers upon surgery, it must, I think,

ligament are considered, the utmost extent of which, at its upper part, does not exceed more than two inches from its origin to its insertion; in addition to which, in the majority of cases, there is considerable resistance afforded by the undivided portion of the fibrous membrane or periosteum."

These are likewise the opinions, every where expressed in the lectures of Boyer, who remarks, "it is easy to conceive, that in a fracture of what is properly the neck of the femur, the orbicular ligament may oppose the derangement;" again, "it rarely happens that the heel is placed above the ankle, except, however, when the fracture is outside the articulation, and the longitudinal derangement very considerable; in fracture of the part, strictly called the neck, it would be necessary, in order that the ankle should be so placed, that the fracture had been produced by a fall upon the feet or knees from a great height, and that the orbicular ligament had been extensively torn." But when the fracture is external to the capsule, there is an opportunity for retraction occurring to its greatest degree, there is, in fact, nothing to prevent the full force of muscular action upon the lower fragment of the bone, while at the same time the upper is forced downwards by the weight of the body, so that from these two causes, a degree of shortening may be produced, equal to or even greater than the entire length of the neck of the bone.

There is, however, one case, in which the retraction may be but slight, although the fracture is external to the capsular ligament: it is that in which the upper fragment is driven a short distance into the cancellated texture of the lower, the ascent of which it not only prevents, but sometimes renders the restoration of the limb to its original length, by extension, a matter of extreme difficulty; however small the distance may be, it is yet sufficient to counteract the force of the muscles, which tend to draw upwards the lower fragment; in such a case, the degree of shortening will be much less than that which is usually the result of fracture external to the capsule; that such is the rela-

tive position of the fragments, we have reason to suspect, whenever unusual difficulty is experienced in detecting crepitus and extending the limb to its original length.

Let us now turn from reasoning to facts, and we will find that the latter confirm what the former would lead us to anticipate. In the museum of the Richmond hospital, there are fifteen examples of fracture of the cervix femoris, thirteen of these are taken from patients who died in the hospital, the degree of shortening in each case was carefully noted, and every precaution taken to insure accuracy of measurement; the following table shews the age and sex of the patients, the situation of the fracture, and degree of shortening.

NO.	AGE.	SEX.	SITUATION.	SHORTENING.
1	36	Male.	Internal.	$\frac{3}{4}$ Inch.
2	48	Do.	Do.	$\frac{1}{2}$
3	74	Do.	External.	$1\frac{1}{2}$
4	80	Female.	Internal.	$1\frac{1}{2}$
5	80	Male.	External.	2
6	70	Female.	Do.	$1\frac{1}{2}$
7	75	Do.	Internal.	1
8	80	Do.	Do.	$\frac{1}{2}$
9	60	Do.	Do.	$1\frac{1}{2}$
10	82	Do.	External.	$\frac{3}{4}$
11	78	Do.	Internal.	$\frac{1}{4}$
12	80	Do.	Do.	$\frac{3}{4}$
13	90	Do.	Do.	$\frac{1}{2}$

From this table it appears that, with the exception of No. 9, the shortening did not exceed one inch in any case of intra-capsular fracture, and reached that extent in only one instance, nor, with the exception of No. 10, was it ever less than one inch and a half in the extra-capsular fracture. With respect to No. 9, the fracture at the time the measurement was made, had existed for years, and the neck of the bone was absorbed, so that the degree of shortening was of course considerable. With respect to No. 10, I shall relate the particulars of the dissection: the neck of the bone was broken at its base, external to

the capsule, and was forced a short distance, about three quarters of an inch, into the cancelli of the shaft, between the two trochanters, it was firmly impacted, and the line of fracture remarkably obscure; the trochanter minor was broken transversely, the line of fracture passing at right angles with the shaft of the bone, but without detaching any part of the process; the descending ramus of the pubis was broken obliquely, the fracture passing downwards and inwards from the thyroid foramen. The patient, a female, 82 ætat. was thrown down by a cart loaded with hay, the horse and cart were stated to have both passed over her; she died upon the fourth day after the injury. In this case the slight degree of shortening may, I think, be fairly referred to the manner in which the fragments were disposed of with regard to each other, and the firmness with which the upper was impacted in the lower, by which muscular force was completely counteracted. It seems probable that the difference of opinion which exists upon this point, is in some measure owing to a proper distinction not having been made between the shortening which comes on during the first two or three days after the accident, the result of muscular action and removable by extension, and that which we notice at a later period, the consequence of absorption, and permanent. Indeed, the period at which shortening occurs is subject to great variety; it may manifest itself instantaneously, immediately after the receipt of the injury, and that to a considerable degree; in such cases I have generally found a comminuted fracture external to the capsule. Sometimes the shortening does not become evident, until perhaps four or six days after the accident; in such cases the muscles have been paralysed by severe contusion; according, however, as they recover their tone, the limb is slowly shortened, and this independent of any process of absorption. Again there are cases in which the retraction, slight at first, becomes at the end of a month or six weeks considerable; No. 11, in the table, was an instance of it: the shortening which at first was only a quarter of an inch, at the expiration of six weeks amounted to one inch

and a half ; it was found after death (which took place about two months after the accident) that the neck of the bone was absorbed. Lastly, there are instances in which the limb retains its natural length for many weeks, and then becomes shortened, not gradually, but suddenly ; these are the cases in which diagnosis has been found so very difficult. The cause which has produced the fracture is, in general, comparatively slight, and the patient has made no attempt to walk after the receipt of the injury ; the eversion of the foot is by no means so well marked, as when the shortening occurs early, nor is there much, if any, change in the position of the trochanter ; the patient, no doubt, is unable to raise the limb *en massè* ; but from this we can draw no certain conclusion, as it may be owing to a paralysed state of the muscles. If we can ascertain crepitus, the diagnosis is no longer difficult, if we cannot, we must only watch the progress of the case attentively, and if, after a period of two, three, or four weeks, the powerless state of the limb continues, we have reason to suspect some more serious injury than contusion ; the eversion of the foot is now more clearly marked, and now also it frequently happens that the limb becomes shortened suddenly ; the knowledge of this fact is not unimportant, as it usually indicates a fracture within the capsule. In the first case in which I observed it, it took place, at the end of three weeks ; in the second, after the lapse of six, when the patient, having left his bed and attempted to walk, the limb (which up to this period retained its natural length) became suddenly shortened : the circumstance has been observed by Sabatier, occurring twenty-three days after the accident. In these instances we must suppose, that at the time of the accident, the close coverings of the neck of the bone having escaped without injury, prevented the retraction of the limb, but that subsequently they were torn, either in consequence of some imprudent exertion on the part of the patient, or too eager a desire on that of the surgeon to ascertain crepitus by powerful extension and rotation of the limb : the retraction then takes place as the immediate consequence of their laceration.

In his Observations on Fractures of the Thigh, Mr. Amesbury remarks, "I have seen three cases in which sudden retraction took place in a few days after the accident, in consequence of the incautious manner in which the parts were examined, which, in fractures within the capsule, can, it seems to me, only be accounted for upon the supposition that the investing membranes were then greatly lacerated, or entirely torn through.

In the second volume of his Clinical Lectures, the Baron Dupuytren makes the following observations, which bear closely upon the point under consideration, "c'est encore ainsi que le déplacement des fragmens ne s'est fait qu'au bout de quelques heures, de deux, trois, cinq, dix et même trente jours, par suite de quelques mouvemens du malade, ou bien pendant que l'on faisait des recherches pour s'assurer de la nature de la maladie. Quelle est la cause de cette particularité que les auteurs ont signalée, que j'ai moi-même observée bien des fois, et dont Sabatier, dans un Mémoire à l'Académie de chirurgie, a cité de nombreux exemples? Elle tient à ce que la fracture a lieu dans la capsule articulaire, que les fragmens sont restés en place, et qu'ils sont reçus, agencés l'un dans l'autre, l'inférieur prenant un point d'appui sur le supérieur. Mais, dira-t-on, comment se fait-il qu'au bout d'un temps plus ou moins long ils s'abandonnent, et que la fracture devienne évidente? C'est parce que les rapports des fragmens changent, ou par le poids du corps, ou par l'action musculaire, ou par l'usure de quelques parties de ces fragmens. Le raccourcissement et la déviation du membre qui sont les suites de ce déplacement des fragmens ne laissent alors aucun doute sur la fracture, s'ils ne reconnaissent pas d'autre cause qu'une chute depuis quelques jours. Les deux signes précédens ne se montrent quelquefois qu'après cinquante, soixante, quatre-vingts jours de traitement par le repos et l'extension, ce qui provient de ce que le cal a cédé à la contraction des muscles ou au poids du corps."

Now what is the exact nature of the accident here referred to? Is it a fracture within the capsule, in which the close co-

verings of the neck of the bone, having escaped unhurt at the time of the accident, have been subsequently torn? or is it a partial fracture, subsequently rendered complete? I am inclined to think that it is the former, and that it is the periosteum of the neck of the bone which yields in consequence of too rough an examination upon our part, or improper exertion upon that of the patient; not the callus, which in fracture within the capsule, I am convinced, from numerous dissections, is not effused in such quantity, as to be in the least capable of counteracting muscular contraction. If the opinion, that in these cases, the fracture is intra-capsular, be correct, I think we must reject the explanation offered by the chief of the Hotel Dieu.

The next symptom which I propose considering is the position of the foot, and here I may observe, that there is no injury as to the nature of which we shall be more frequently deceived, if we form our diagnosis from the presence or absence of any one particular symptom, than fracture of the neck of the femur, nor is it unimportant to ascertain whether there has been any previous affection of the hip joint. We have seen that the alteration which the limb usually suffers with respect to length, cannot aid us in forming our opinion in every case, as it does not always occur immediately after the accident: so is it with respect to eversion of the foot; we cannot pronounce that the bone is broken, because this symptom is present; neither from its absence can we infer the non-existence of fracture, for it is now well known, that the foot may be turned either inwards or outwards, or remain unaffected by the injury. The following case will serve to show the uncertainty of eversion, as a diagnostic sign, not only when separately considered, but even when combined with a shortened state of the limb. A woman of advanced age was admitted into the Richmond Hospital, having received an injury of the hip joint, by a fall upon the trochanter; on examination, the patient having been placed in the horizontal posture, the affected limb was found to be one inch shorter than the sound one; the foot was everted, and the thigh could not be

flexed upon the abdomen, as long as the leg was extended upon the thigh ; the pain and contusion about the joint were considerable. These symptoms were quite sufficient to justify the opinion that the neck of the femur was fractured ; but upon endeavouring to ascertain crepitus, I found it quite impossible to extend the limb to its natural length ; this of course raised a doubt as to the true nature of the injury, and made me suspect that there had been some previous affection of the joint. Upon being questioned, the patient stated that she had long been subject to pain and stiffness in the joint ; that the pain was affected by the weather, being worse in damp, foggy seasons ; that it was relieved by a night's rest, but increased towards evening, and that she had gradually become lame, her general health being unimpaired. It was now, therefore, evident, that the case was one of severe contusion of a joint, previously affected by morbus coxæ senilis, a disease of frequent occurrence in old people, and one which produces shortening of the limb and eversion of the foot.

Nor is it only with regard to the nature of the injury which the hip joint has sustained, that the presence of this peculiar affection may deceive us ; for even though the neck of the bone be undoubtedly broken, we may fall into error as to the seat of the fracture, and find it almost impossible to say whether it is within or without the capsule, because the degree of shortening can no longer guide us, as part of it must be ascribed to the absorption which the neck of the bone suffers in this disease ; however, in all the cases that I have seen, in which the fracture was complicated with this affection of the joint, the injury has been external to the capsule.

Let us now consider those cases, in which the foot is more or less inverted, a state first noticed by Parè and Petit ; in the 13th vol. of the Medico-Chirurgical Transactions, a paper has been published by Mr. Guthrie, in which he thus endeavours to explain its occurrence : “ When the fracture has taken place in such a manner, as to be external to the insertion of the rotators outwards, yet sufficiently within that of the glutæus medius

and minimus, so as not to deprive them of their due action, the toe will be turned inwards, and must always be so, or remain without any change of position, according to certain variations in the inclination of the fracture affecting the power of these muscles." This explanation may suffice, as far as regards fracture external to the capsule, in which alone, according to Mr. Guthrie, can inversion of the foot occur, for the third inference which he draws from his observations is, "that inversion of the foot does not take place in fracture within the capsular ligament, and that this symptom is rather diagnostic of fracture through the trochanter major, a portion of it being continuous with the shaft of the bone." But in the same volume, we find recorded by Mr. Stanley, a case of fracture within the capsule, accompanied by inversion of the foot, and I have myself seen an instance of the kind. In his remarks upon the case, Mr. Stanley observes: "in the instance of fracture within the capsule, the portions of synovial and fibrous membrane which had escaped laceration upon the anterior side of the neck of the bone, might probably prevent the limb from being turned outwards, but why it should have been turned inwards, I confess myself at a loss to explain." Although I can scarcely admit, that the circumstance of the fibrous membrane remaining entire upon the front of the neck of the bone, would prevent eversion, (for I have seen many instances to the contrary,) yet as to the state of inversion, I am equally at a loss to account for it, as a symptom of fracture within the capsule. I have seen three cases of fracture of the neck of the femur, accompanied by inversion of the foot, in one of which, the injury was within the capsule. These cases cannot be considered with too much attention, as they are particularly liable to be confounded with dislocations, and the consequences of such an error have been fatal.

In the paper of Mr. Stanley's already alluded to, the following remarks occur: "among the more complicated injuries to which the hip joint is exposed, that of fracture of the trochanter major, combined with fracture of the neck of the bone, has,

under certain circumstances, a strong resemblance to dislocation of the bone. Whenever the fractured portions of the trochanter can be brought into contact, a crepitus will be perceived, which will enable the surgeon to ascertain the precise nature of the injury; but when, from the direction of the fracture, one portion of the trochanter has been drawn by the action of the muscles towards the sciatic notch, no crepitus may then be discoverable; a direct source of mistake will then arise from the positive resemblance of the fractured portion of the trochanter to the head of the femur, the former occupying the same place, which the latter would do in dislocation, and if, with these circumstances, there should happen to be inversion of the injured limb, the difficulty of diagnosis must be considerably increased."

The following case completely illustrates the preceding observations. Patrick Murphy, æt. 80, was admitted into the Richmond Hospital, February 18th, 1832, for an injury of the hip, caused by a fall, and attended by the following symptoms: considerable tumefaction and ecchymosis about the joint; the injured limb was two inches shorter than the sound one; the foot was inverted, the limb in the state of adduction; a large ~~long~~ ⁶⁻⁸ tumour could be felt upon the dorsum of the ilium, a little above the sciatic notch, resembling somewhat in its form, the head of the femur; the shortening of the limb could not be perfectly removed by extension.

Here, therefore, was a case more likely than any other to be confounded with dislocation upon the dorsum ilii, from which, however, by attentive examination, it was distinguished, for the thigh could be flexed upon the abdomen, the shortening of the limb, partially removed by extension, recurred when the extending force ceased, and finally the tumour upon the dorsum ilii did not follow the motions given to the thigh: it was therefore looked upon as a case of fracture through the neck of the bone and trochanters. The presence of morbus coxæ senilis was inferred, from the patient having stated, that he had long been subject to pain in the joint, that he limped when walking, and

that of late the affected limb had become shorter than the other. He died about fourteen days after the accident. Upon examination of the joint, the following appearances were observed: a transverse serrated fracture external to the capsule, at the line of junction of the neck with the shaft of the bone; a second fracture had completely detached the great trochanter, which was enlarged and drawn towards the sciatic notch, carrying with it the insertions of the pyriformis, gemelli, obturator, and a large portion of the glutæus maximus; a third fracture had detached the trochanter minor, carrying away the insertions of the psoas magnus, and iliacus internus; a hard, polished, ivory-like substance was deposited around the head of the bone, at the circumference of its cartilage.*

I have seen only one example of fracture more extensive than the above: in the case to which I allude, the neck of the bone was broken external to the capsule, both trochanters detached, the greater broken into two portions, the posterior surface of the femur between the two roots of the linea aspera detached, and a number of loose fragments lay between the ends of the bone. In cases of such extensive injury as this, the diagnosis is sufficiently simple, although the position of the foot is uncertain; it may be turned either inwards or outwards, or there may be inversion at one time, eversion at another, for it will generally remain in whatever position it has been accidentally placed.

The dislocation upon the dorsum of the ilium, that into the sciatic notch and fracture of the neck of the femur, attended with inversion of the foot, are to be distinguished from each other, according to Mr. Guthrie, by comparison or a due estimate of the degree of inversion; in the first case, the inversion is complete, the great toe resting against the instep of the opposite foot; in the second it is less complete, the toe resting

* See Plate, fig. 2, and No. 5, in the Table, p. 209.

against the ball of that of the opposite foot ; and in the third, it is still less complete, the great toe merely turning towards the opposite one." Attention, therefore, to the degree of inversion, as indicated by the position of the great toe, throws some light upon the nature of the injury, which is rendered still more evident, by observing the facility (so far as mechanical resistance is concerned) with which, in the case of fracture, the foot may be everted, the thigh flexed upon the abdomen, and the limb restored to its natural length by extension, and comparing its free, loose, powerless condition, with its almost immoveably fixed state in dislocation.

For the following very interesting case, I am indebted to my friend, Mr. Power, one of the demonstrators at the Richmond School of Anatomy. — Doolan, æt. 75, was admitted into Jervis-street Hospital, under the care of Mr. Adams, February 17th, 1831, labouring under a severe injury of the hip joint. The limb presented the following appearances : the hip was considerably swollen ; the trochanter major appeared twice its natural size, and drawn up on a level with the anterior superior spine of the ilium ; a considerable hollow was evident in the groin ; the limb was shortened four inches ; the foot was inverted ; rotation outwards could be performed, but imperfectly, and was attended with severe pain : on making extension and rotating the limb, an indistinct crepitus was perceptible. The patient stated that on February 1st, while endeavouring to unlock a door, he fell upon a heap of stones, upon the left hip ; on attempting to rise, he found himself unable to do so, and in this state was carried to the hospital. The appearance of the limb excited a good deal of interest ; and it was supposed that from its previous history, something might be elicited to clear up the doubts which existed as to the immediate cause of its present appearance. However, all that could be ascertained was, that many years ago he noticed a stiffness in that hip ; that gradually the limb became shorter and shorter ; that he contracted a halt, but that he never was confined to his bed in consequence

of the affection. The patient died about a fortnight after his admission. An inspection of the body was procured. The joint being removed and carefully examined, it was found that a fracture had taken place in such a manner, that the trochanter major was broken obliquely from the shaft of the bone, yet still connected with it by a slip of periosteum; it was considerably increased in size; the fracture occurred so as to leave attached to the trochanter, the pyriformis, gemelli, obturatores, and quadratus femoris; the trochanter minor was also completely detached, bringing away with it about two inches of the bone itself; the psoas magnus and iliacus internus were attached to this fragment; the neck of the bone was broken at its base. These were all the circumstances connected with the injury; but as it was suspected that there were other appearances in the interior of the joint, worthy of notice, it was laid open, and the condition of the parts here disclosed, satisfactorily accounted for the train of symptoms which the patient described as having occurred previous to the recent injury. A quantity of bone was deposited at the root of the head of the femur; it required some force to pull the head from the socket, and upon doing so it was found that the ligamentum teres had entirely disappeared; the cartilage covering the head of the bone was almost entirely absorbed, and in its place there was deposited a complete enamel, or something resembling ivory, smooth and polished; the head itself was altered in shape, it was larger than natural, and flattened upon its upper surface. The acetabulum was greatly enlarged, and lined by the same material as that covering the head of the femur; there was no trace of the substance termed Haversian gland, and the pit for its reception had entirely disappeared. When the fractured portions of the bone were restored to their original position, it was found that the neck of the bone was quite horizontal, and that from this cause, and from its increased size, the trochanter major was situated above the level of the head of the bone.

This case was similar to that of Murphy; both were liable

to be confounded with dislocation ; the great degree of shortening in Doolan's case, was partly owing to the horizontal position of the neck of the bone, the result of previous disease, and in consequence of which, a considerable shortening had existed before the occurrence of the accident.

We now come to consider an injury of the hip joint, which has not hitherto received the close attention it merits, and the diagnosis of which is always most difficult. I allude to the partial fracture of the neck of the femur.

While this paper was read before the Surgical Society, Mr. Adams, whose accuracy of observation and skill in diagnosis are so well known and appreciated by the profession, took occasion to make some remarks, the substance of which he has communicated to me, and allowed me to introduce here, which I have great pleasure in doing, as they bear so entirely upon the subject of my paper.

“ It not unfrequently happens, that the surgeon is called to visit a patient, who by a fall on one of the trochanters, has suffered an injury of the hip, which generally at once incapacitates him from rising from the ground, and upon the nature of which it is most difficult to give a decided opinion : it presents some of the characters of fracture of the neck of the femur, but the more striking features of the accident are absent. The patient, in general, has a species of consciousness that he is unable to stand or walk, and therefore does not attempt either ; he is unable to raise, by one voluntary effort, the limb from the floor or bed, on which it is extended, but the limb does not lie everted in that prostrate, powerless state, which in its whole expression announces the complete fracture of the cervix femoris : on the contrary, while the patient lies on his back, he can shorten the lower extremity at will, and without pain, by flexing the leg on the thigh and the latter on the abdomen ; indeed, when we enter the room in which the patient is, we usually find the limb in this position, the knee raised from the bed, and supporting the weight of the

bed clothes, a circumstance which would strongly confirm the surgeon's prejudice, that in such a case no fracture existed; nor would any examination but a most careful one disabuse his mind, for he would find that even in the extended position there is no eversion. It is remarkable, too, that there is no perceptible diminution in the length of the limb: there is no crepitus, and in seeking for it, rotation can be performed inwards and outwards without causing the usual pain. The trochanter major not having lost the support afforded to it by the neck of the bone, does not fall back towards the ischium, as it generally does in the case of complete fracture; on the contrary, it seems to project more than natural, and if we wish to satisfy our mind on the true nature of the case, we must support the patient in the erect posture, and we are at once struck with the prominent position of the injured hip.

“Although the surgeon is always expected to give a decided opinion almost at sight, as to the question whether the bone be broken or not, it is often a matter of serious difficulty to pronounce positively upon the nature of the accident; and the memory of every surgeon will present him with cases in which he has felt all this difficulty in coming to a conclusion in his own mind, under such circumstances. When, however, a month or six weeks shall have elapsed from the period of the receipt of the injury, if now a new examination be made, the limb will be found shortened and the toe everted.

“As to what is the real nature of this injury, is a question which can only be replied to satisfactorily by the post mortem appearances, revealed by the anatomical examination of persons, who, during life, received injuries of the hip, which presented the peculiar characters of the accident here described. Opportunities, however, for such complete observation and subsequent investigation very seldom occur, as such accidents are not usually mortal.

“For my part, I am satisfied, I know some living instances of

patients who have suffered the accident I am here alluding to, the partial fracture of the neck of the femur, and I have in my possession thigh bones which are undoubted examples of such a lesion ; but I must confess that the instances are very few I can adduce, in which I can fairly connect the symptoms I have assigned to partial fracture of the cervix femoris with the pathological changes which characterize the injury.

“ These changes, however, I shall just now endeavour to explain ; but first let us direct our attention for a moment to the natural structure of the neck of the femur, the anatomy of the interior of which, considering the lengthened discussions that its accidents and injuries have given rise to, has been marvelously overlooked.

“ For this purpose, let us make a vertical section through the neck of a healthy femur, in the direction of its long axis, and continue it down through the shaft of the dry bone, the section leaving one half of the femur in front, and the other behind with the lesser trochanter, as has been done in the specimen of the healthy femur of a well formed adult man, from which fig. 4, in the plate has been taken. This simple view shews us that the principal strength of the neck resides in an arch of compact tissue, which begins small where the globular head joins the under part of the neck, but which gradually enlarges downwards towards the lesser trochanter, and even so low as the middle of the femur, where it will be found nearly twice the breadth of the opposite wall of the shaft of the bone : the compact stratum, which, scarcely thicker than a wafer, invests the entire of the head, upper part of the neck, and trochanter, seems to have little reference to any design of imparting strength or resistance to this portion of the bone, and the same may be said of the whole of the reticular tissue of these processes, while, on the contrary, the compact tissue of the *under surface* of the neck seems artfully arranged, if we can so say, so as to give support to the weight of the body in the erect position ; hence

do we find this compact stratum thrown into an arch, upon which the weight of the body falls, as that of a carriage does on the C spring which sustains it.

“When we fall or leap from a height on the feet or knees, the thin upper stratum of the neck, and the whole of the reticular tissue of the bone, will first receive and probably yield somewhat to the weight, by which some of the force of the shock may be decomposed, but to the long arch of compact tissue, to which we have alluded, must ultimately be referred any violence which the neck of the femur can receive from any impulse transmitted from above.

“We seldom hear of a fracture of the neck of the femur occurring to a healthy adult, when he falls with violence on his feet or knees, for the weight of the superincumbent body is thrown in the most favourable manner on the bony arch of compact tissue before alluded to, which, from its density and form, and strength derivable from both, it is almost always able to resist; and even a fracture of the acetabulum, or rupture of the capsular ligament and dislocation, are accidents more likely to happen under these circumstances.

“But on the other hand, let us suppose a person to fall on the trochanter major, which is resisted by the ground, while the weight of the pelvis, &c. acting obliquely on the under surface of the neck, will have a tendency to bring the neck of the femur into a straight line with the shaft of the bone, or in other words, to efface its obliquity: here the compact tissue, so often alluded to, receives the force from below in a most unfavourable manner, and this tissue cracks across, and if no more happens for the present, we shall have the simplest form of partial fracture of the neck of the femur. The possibility of such an accident occurring, implies the certainty that there is toughness and tenacity enough of the material composing the reticular part of the neck of the femur, to yield without breaking, of which there can be now no doubt entertained.

“While circumstances are in this state, we can conceive the

possibility of a patient being able to stand after such an accident, and even walk for some distance; and when examined by the surgeon, we can understand how the latter, as it has often happened, might be deceived into the opinion that there was really no fracture. Again, we can easily imagine, that under such circumstances an awkward movement or a fall may render the fracture complete, or how, from a severe secondary injury, or even the continued action of the first impulse, somewhat varied in its direction, the upper fragment of the broken neck of the femur could be wedged into the cancelli of the shaft, but these matters it is not my object to discuss. I would wish now merely to investigate the cause of the subsequent change, which the unbroken part of the neck of the femur slowly undergoes, after the fracture of that compact stratum, which constitutes the chief strength of the cervix femoris, and to explain anatomically why the accident, at first so obscure, after six weeks have elapsed, becomes so evident as not to be mistaken.

“The neck of the femur is in this case shortened, because the compact tissue, in which resides the principal strength of the neck, has lost its continuity, and can no longer resist the action of those forces, which have a constant tendency to shorten the neck; and ultimately everted, because although the reticular tissue of the neck of the femur may have elasticity enough to allow of a change of form, without being absolutely crushed by the force which produced the partial fracture of the neck; yet it is probable that at the moment of the accident, the cellular tissue in which the vital elements of the bone reside, may have received a shock or concussion, which render the bone susceptible of a subsequent shortening or interstitial absorption, in consequence of which it will readily yield to the action of the muscles, and the limb after a time be everted.

“When we remove the femur from the acetabulum, which has been the subject of this partial fracture of its neck, and examine it, we shall uniformly observe that the threefold obliquity of the neck, viz., upwards, forwards, and inwards, are lost, and

that the head and neck of the bone are directed simply, horizontally inwards, at right angles with the shaft. Viewed posteriorly the intertrochanteric line, in all the cases I have examined, seemed to have been the seat of osseous deposition, and the interval between this and the head, which constitutes the back part of the neck, was diminished one-third; in a word, the shortening and eversion are here anatomically accounted for by the loss of obliquity, and the loss of length of the posterior part of the neck of the femur, the amount of which loss will give the measure of these remarkable phenomena of shortening and eversion.

“When we make a vertical section of the femur, which has been done in the specimen from which fig. 3 has been taken, as we did in the femur of an adult in its normal state, we observe that the compact structure at the upper part of the cervix, and the whole of the reticular tissue, shew not a trace of fracture or any alteration, except that of loss of obliquity; but if we examine the compact arch of bony material which stretches from the lesser trochanter to the under part of the head, we find that this has been the seat of fracture, and that by a gradual or sudden effort, it has been driven into the cancelli of the shaft of the femur, and with the compact tissue of the latter forms a T like disposition of their structures, as will be seen in fig. 3.

“This species of fracture was first noticed by Dr. Colles, and has since been briefly alluded to by Amesbury and others. Notwithstanding all that has been advanced, I feel the imperfection of our knowledge of this subject, and the inadequacy of these facts and observations to settle a matter of much practical importance. Still I am not without a hope that these remarks, imperfect as they are, may awaken attention to the subject of the partial fracture of the cervix femoris, and give rise to discussion, that cannot fail to be useful to science.”—R. ADAMS.

I shall now in conclusion make a few remarks upon that disease of the hip, which I have more than once alluded to, as modifying the symptoms of the accidents to which the joint

is liable, and obscuring their nature. The disease in question has been termed *morbus coxæ senilis*, to distinguish it from the scrofulous affection of the joint, which occurs in young people, and from which it differs in every respect: it appears to be the same affection as that described by Mr. Benjamin Bell, under the title of *Interstitial Absorption of the Neck of the Thigh Bone*: it is seldom seen under the age of fifty, is chiefly met with among the labouring poor, in constitutions otherwise healthy; it is however occasionally seen among the higher classes. It commences with pain and stiffness in the joint, the pain does not continue with any degree of severity: after walking some distance, the stiffness wears off, and the joint becomes supple, but towards evening, the uneasiness increases, until relieved by a night's rest; it is worse in damp, foggy seasons, and is aggravated by heat; the limb shortens by slow degrees, and the patient walks lame, but can apply the sole of the foot flat to the ground; the toes are turned outwards, the lumbar vertebræ acquire a great degree of mobility, the opposite buttock becomes prominent, and its muscles strong, while upon the affected side, the nates lose their prominence, and their fold disappears, but the muscles never become soft or flaccid, they remain as firm to the feel as in health; the spine acquires a lateral curve: the disease never advances to suppuration, nor does it at all endanger life, the general health is good, but the temper irritable. The affection is not peculiar to the hip, being occasionally met with in the shoulder-joint; it occurs at the same period of life, and sometimes in conjunction with the ossification of the arteries, or enlargement of the middle lobe of the prostate gland.

When we have an opportunity of examining the joint, we find remarkable changes in every structure entering into its composition. The capsular ligament is always much thickened, the cotyloid ligament is either ossified or absorbed, and the ligamentum teres is invariably destroyed, even in the early stages of the disease: the substance termed Haversian gland is

also removed, and the pit where it is accommodated disappears ; the cartilage of the acetabulum is absorbed, and its place occupied by a dense enamel ; the cavity itself undergoes various alterations of form and size : sometimes it is increased to three times its natural size, becoming also remarkably shallow, while in other instances, it is deepened without an increase of diameter, bony matter being deposited around its margin, so as to encircle the head of the femur, and render its extraction from the socket extremely difficult : the cartilage of the head of the femur is likewise absorbed, and in the early stages of the disease, the surface of the bone presents a peculiar porous appearance, or as Mr. B. Bell expresses it, “the bone is as it were drilled by an infinite number of minute holes, of calibre varying from the fifth of a line to a line in diameter. These holes, on minute examination, do not appear to penetrate deeper than the shell or external table of the bone, and are filled by the processes of periosteum, which envelope the vessels of the osseous tissue.” But when the disease has existed for a long time, there is deposited upon the surface of the bone, a hard, dense enamel, smooth, white, and polished, like ivory ; the spherical form of the head of the bone is changed ; in recent cases, it is merely flattened from above downwards, but when the disease has been of long standing, it becomes greatly increased in size, keeping pace with the enlargement of the acetabulum, to the irregular form of which it is also adapted. The neck of the femur undergoes either partial or total absorption, and the head sinks to a right angle with the shaft, and appears to spring directly from it ; bony matter is deposited in considerable quantity about both trochanters, “the lower part of the neck of the bone seeming as it were encased in a sheath of osseous matter, which is sometimes of a spongy texture, and sometimes of a dense structure, and presenting an irregular stalactitic surface.” —“It is those cases of interstitial absorption which are combined with exostotic deposition, that are apt to be confounded

with fracture of the neck of the thigh bone.”* A vertical section of the bone in this state, bears a very close resemblance to fracture of the cervix external to the capsule, which had become united, and I have no doubt, has often been mistaken for it. When the disease occurs in the scapulo-humeral articulation, it causes a flattened appearance of the shoulder, and the long tendon of the biceps muscle is destroyed. It is impossible to confound the disease with the scrofulous affection of the hip, inasmuch as it occurs at an advanced period of life, never advances to suppuration, nor is the bone ever dislocated ; it is unattended by constitutional disturbance, never endangers life, derives little benefit from treatment, and the patient, though he walks lame, is able to put the sole of the foot flat to the ground.

From all that has been said in the preceding pages, I think I am justified in deducing the following conclusions :

1. The less the degree of shortening, the greater is the probability, that the fracture is within the capsular ligament.

2. The degree of shortening when the fracture is within the capsular ligament, varies from a quarter of an inch to one inch ; when external to the capsule, from one inch and a half to two inches and a half.

3. The limb may remain without any change in length for many weeks after the receipt of the injury, then retraction may suddenly occur.

4. This sudden retraction, at a period more or less remote from the receipt of the injury, indicates a fracture within the capsule.

- 5th. The presence of morbus coxæ senilis may not only lead us to suppose that a fracture exists, when the bone is entire, but also, when there is no doubt as to the existence of fracture,

* Bell on Diseases of the Bones, page 95.

may render diagnosis difficult as to the seat of the injury with respect to the capsule.

6. Inversion of the foot may accompany fracture within the capsular ligament.

7. The accident most liable to be confounded with dislocation upon the dorsum ilii, is fracture through the trochanters, together with inversion of the foot.

8th. The degree of shortening when the fracture is within the capsule, chiefly depends upon the extent to which the fibrous reduplications have been torn.

9. When the hip joint, long affected by that disease peculiar to old people, receives a severe contusion, we distinguish the accident from fracture of the neck of the bone, by the impossibility of restoring the limb to its natural length by extension, and also by an inquiry into previous history.

EXPLANATION OF PLATE.

Fig. I. Fracture of the cervix femoris within the capsule; the fracture passes obliquely downwards and backwards, its highest part being in front, where it encroaches upon the head of the bone; the fibrous reduplications, entire upon the posterior surface of the cervix, have suffered anteriorly a very slight laceration.

- a The fracture.
- b The fibrous reduplications.

Fig. II. Fracture of the cervix femoris, external to the capsule; fracture through both trochanters.

- a Trochanter major separated from the shaft, and drawn upwards.
- b Trochanter minor broken off, along with a portion of the shaft of the femur.
- c Osseous deposition around the head of the femur.
- d Fracture through the cervix femoris.

Fig. III. Vertical section of the head, neck, and a portion of the shaft of the femur, shewing partial fracture of the cervix united by bone.

- a The compact tissue which lines the concavity of the cervix femoris, forced into the cancellated tissue, and united at a right angle with the compact tissue of the shaft.
- b Trochanter minor.

Fig. IV. Vertical section of the head, neck, and a portion of the shaft of the femur of a well-formed adult male.

- a The arch of compact tissue, which, lining the concavity of the cervix, increases gradually down to b, where it is double the thickness of the opposite wall of the femur, d.
- c The thin layer of compact tissue which invests the upper surface of the cervix.

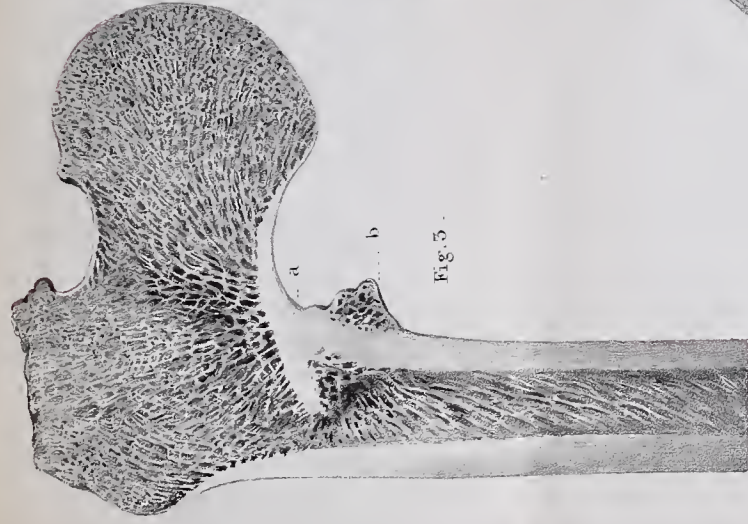


Fig. 3.



Fig. 2.

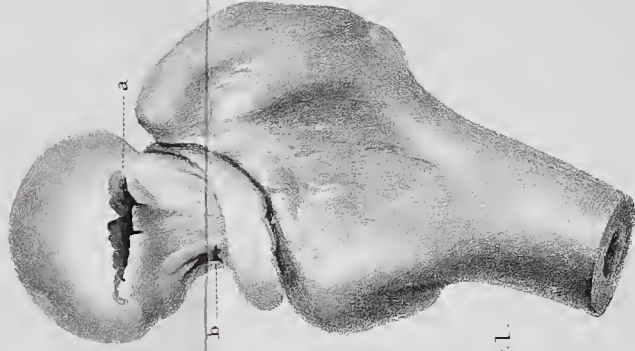


Fig. 1.

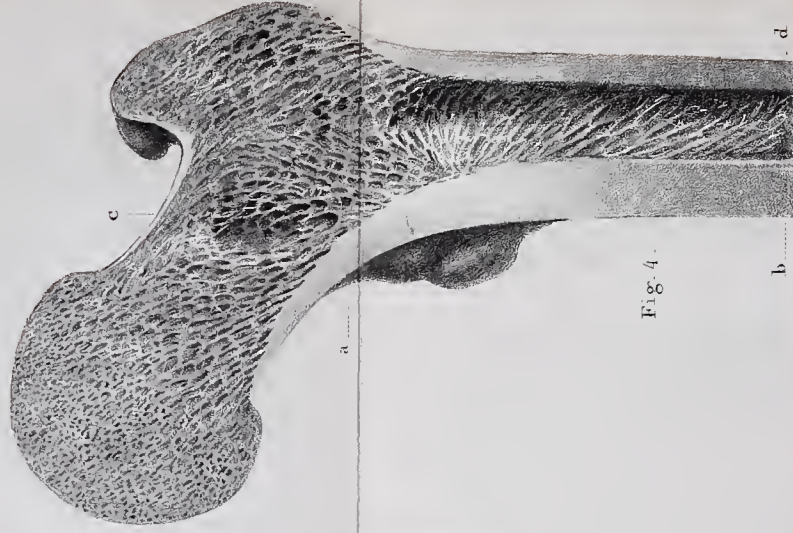


Fig. 4.

